I.Rábano, R. Gozalo and D. García-Bellido (Eds.), Advances in trilobite research.
Cuadernos del Museo Geominero, nº 9. Instituto Geológico y Minero de España, Madrid, 2008. ISBN 978-84-7840-759-0

TRILOBITES FROM THE VARGAS PEÑA FORMATION (LLANDOVERY) OF ITAUGUÁ, EASTERN PARAGUAY

M. Franco Tortello1, Euan N.K. Clarkson2, Norberto J. Uriz3, Marta B. Alfaro3 and Julio César Galeano Inchausti4

1 División Paleontología Invertebrados, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina. tortello@fcnym.unlp.edu.ar
2 Grant Institute, School of Geosciences, University of Edinburgh,West Mains Road, Edinburgh EH9 3JW, United Kingdom.
Euan.Clarkson@glg.ed.ac.uk
3 División Geología, Museo de La Plata, Paseo del Bosque s/n, 1900 La Plata, Argentina. nuriz@fcnym.unlp.edu.ar, malfaro@fcnym.unlp.edu.ar
4 Ministerio de Obras Públicas y Comunicaciones, Subsecretaría de Minas y Energía, República del Paraguay. galeanojc@hotmail.com

Key words: Trilobites, Vargas Peña Formation, Llandovery, Itauguá, Paraguay.

INTRODUCTION

The Itacurubi Group (Harrington, 1972) represents the Lower Silurian of the intracratonic Paraná Basin in eastern Paraguay. The group comprises the Eusebio Ayala, Vargas Peña and Cariy formations, which document a Llandovery transgressive-regressive cycle. The clay-shales of the Vargas Peña Formation were deposited during the maximum flooding of the transgressive event, and contain trilobites and other marine invertebrates of malvinokaffric affinity (e.g. see Harrington, 1950; Wolfart, 1961; Benedetto et al., 1992 and references therein; Uriz et al., 2006 and references therein).

The trilobites from the type area of the Vargas Peña Formation (Vargas Peña clay pit =San Fernando Quarry) were originally studied by Harrington (1950, 1972), who described Calymene boettneri from the uppermost part of the unit. Subsequently Wolfart (1961) reported scarce material assigned to Calymene sp., Calymene boettneri Harrington, Dalmanites? sp. and Eophacops sp. In addition, Baldis and Hansen (1980) described the giant dalmanitid "Guaranites" paraguayensis from the San Fernando Quarry, but they did not provide information about its exact stratigraphic location.

New fossil samples from the Vargas Peña Formation at the San Fernando Quarry were recently collected. The aim of the present paper is to provide new data and records of trilobite species. This study includes the description of a columnar section representing the face of the quarry. The stratigraphic control is based on graptolites recorded from lower to upper parts of the formation (Uriz et al., 2006, in prep.). 395

LOCATION AND AGE

The San Fernando Quarry is located close to Itauguá city, 60 km E of Asunción city, Paraguay (Fig. 1). Here, the Vargas Peña Formation is represented by light clays and micaceous shales about 25 m thick. Theunit has yielded numerous macrofossils such as trilobites, graptolites,

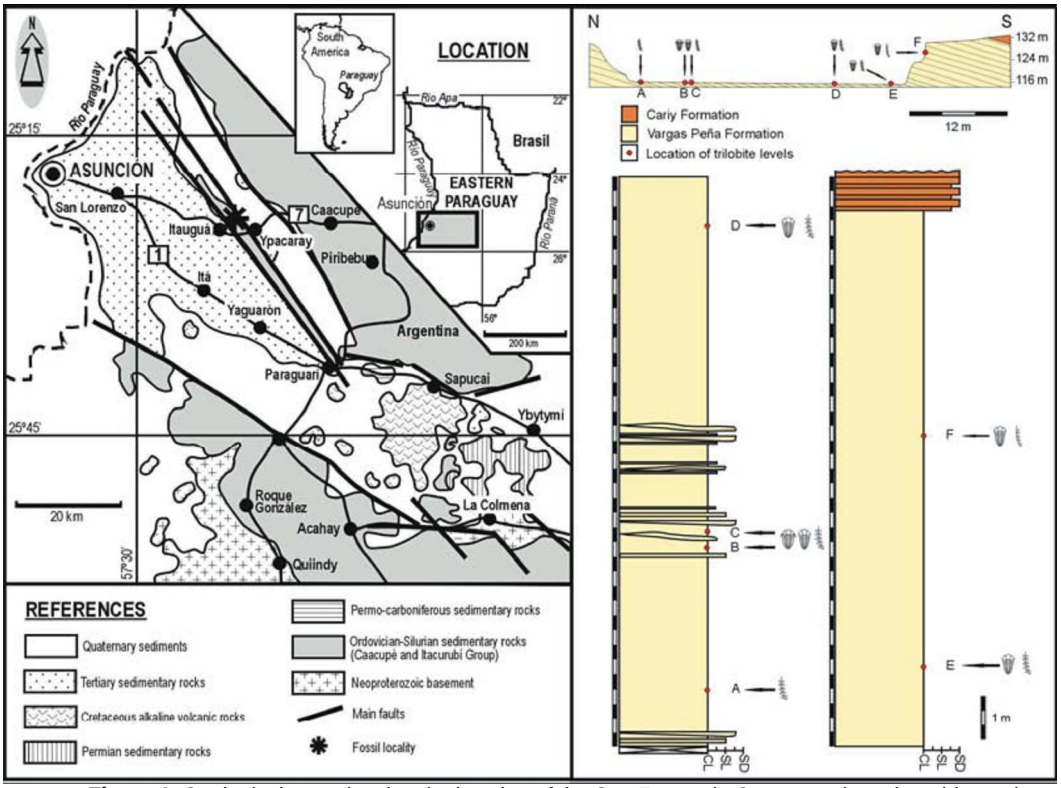

Figure 1. Geological map showing the location of the San Fernando Quarry, and stratigraphic section of the Vargas Peña Formation, showing all sampled horizons.

brachiopods, bivalves, gastropods, tentaculítids, nautiloids, hyoliths and crinoids. The trilobite levels are in the lower middle and upper parts of the formation (B-F, see Fig. 1). Levels A, B and C are characterized by the graptolite genera Normalograptus Legrand, 1987 and Glyptograptus Lapworth, 1873 (emend. Koren and Rickards, 1996), which suggest a Rhuddanian age (Uriz et al., in prep.). On the other hand, the graptolites recorded from the top of the section (level F) [Monograptus aff. priodon (Bronn), Stimulograptus sedgwickii (Portlock), ?Demirastrites sp.] are Aeronian – Telychian in age (Uriz et al., 2006).

NOTES ON THE FOSSILS

The specimens studied are very fragile external and internal moulds, so special care is needed during
preparation. They are housed in the Museo de Ciencias Naturales de La Plata (MLP), Argentina.

Family Calymenidae Milne Edwards, 1840
Subfamily Calymeninae Milne Edwards, 1840
Genus Calymene Brongniart, 1822

Type species. Calymene blumenbachii Brongniart, from the Wenlock of England.

Calymene boettneri Harrington, 1950
(Pl. 1, figs. 1-7, 9)

1950. Calymene boettneri n. sp. Harrington, p. 73-76, pl. 1, figs. 1-3.

Material. Four complete specimens, 14 axial shields, 3 cephala, 4 cranidia, 11 thoraco-pygidia and 1 pygidium (MLP 31869-31901), levels ?C, D-F.

Remarks. Harrington (1950) provided a complete description of this species. Calymene boettneri differs from C. ferrifera Baldis and Blasco (in Baldis et al., 1976, pl. 1, figs. 1-3), from the Silurian Lipeón Formation (NW Argentina), by the presence of a more rounded preglabellar furrow, a more convex frontal lobe of the glabella, subtriangular lateral glabellar lobes (L1 and L2), and an occipital furrow of uniform width. It can be differentiated from C. vallecitoensis Waisfeld et al. (1988, pl. 1, figs. 1-8), from the Silurian Los Espejos Formation (Precordillera, western Argentina), by having a longer, not truncated glabella, a forward-curving occipital furrow, a slightly less raised pygidial axis which has 5-6 axial rings, less laterally expanded pleural fields, and fainter interpleural furrows.

Some materials from level C (3 axial shields and 2 thoraco-pygidia, MLP 31902, 31905, 31907, 31910; see Pl. 1, figs. 10, 11) could be conspecific with C. boettneri; however, they represent incomplete, slightly distorted individuals, so an unequivocal identification is not possible.

Calymene cf. boettneri Harrington, 1950
(Pl. 1, figs. 8, 12)

Material. One axial shield, 4 cranidia and 3 thoraco-pygidia (MLP 31903, 31908, 31911 31913, 31917, 31919, 31928), levels B, C.

Remarks. This taxon mostly resembles Calymene boettneri Harrington in having a rounded preglabellar furrow, a forward-curving occipital furrow, and eyes located moderately far the glabella, opposite glabellar lobe L2. However, the former differs in its less convex frontal lobe of the glabella and its less tumid L1 and L2.

Calymene sp. A
(Pl. 1, figs. 13-16)

1961. Calymene boettneri Harrington.Wolfart, p. 72, pl. 4, fig. 4,?5.

Material. Six cranidia (MLP 31904, 31906, 31911, 31914, 31916, 31935), levels B, C.

Remarks. Calymene sp. A is characterized by having a glabella constricted at L2, with a moderately convex, subquadrate frontal glabellar lobe, a larger, slightly more teardrop-shaped L1, and a wide, very slightly forwardly curving occipital furrow. These specimens are closely similar to the cephalon from the Vargas Peña Quarry assigned by Wolfart (1961, pl. 4, fig. 4) to C. boettneri. Similarly, an associated pygidium (see Wolfart, 1961, pl. 4, fig. 5) could be conspecific.

Subfamily Homalonotidae Chapman, 1890
Subfamily Homalonotidae Chapman, 1890
Genus Trimerus Green, 1832

Type species. Trimerus delphinocephalus Green, from the Wenlock of USA.

Trimerus sp.
(Figs. 2.5, 2.6)

Material. Two pygidia (MLP 31939, 31940), levels B, C.

Remarks. The pygidia found are ovate to subtriangular in outline, highly convex, with a gently tapering axis and indications of 10 axial rings, 7-8 pleural ribs and a short posterior mucro (see Fig. 2.5). These features enable the specimens to be assigned to Trimerus. Since the material is very scarce, it is left under open nomenclature.

Family Dalmanitidae Vodges, 1890
Genus Dalmanites Barrande, 1852

Type species. Trilobus caudatus Brünnich, from the Wenlock of England.

Dalmanites ypacarayensis (Baldis and Hansen, 1980)
(Figs. 2.1-2.4)

1980. Makaspis ypacarayensis sp. nov. Baldis and Hansen, p. 53-54, pl. 1, fig. A, pl. 2, fig. a.
1961. Dalmanites? sp.Wolfart, p. 74, pl. 4, fig. 8.

Material. Two cephala, 2 thoraco-pygidia and 3 pygidia (MLP 31922, 31930-31933, 31937, 31938), levels B, C.

Remarks. The cephala studied herein do not differ from that originally described as Makaspis ypacarayensis by Baldis and Hansen (1980, pl. 2, fig. a). Associated pygidia are slightly convex, subtriangular in outline, with a posterior process. The pygidial axis is conical in outline and composed of 8 rings and a terminal piece, whereas the pleural fields show 7 pairs of pleural furrows that are progressively curved backwards, and faint interpleural furrows.

According to Edgecombe (in Jell and Adrain, 2003), Makaspis Baldis and Hansen is a junior synonym of Dalmanites. As suggested by Baldis and Hansen (1980, p. 53), D. ypacarayensis seems to be conspecific with the poorly preserved cranidium from the Vargas Peña Quarry assigned by Wolfart (1961, pl. 4, fig. 8) to Dalmanites? sp. Dalmanites ypacarayensis differs from D. sudamericanus Benedetto and Martel in Baldis et al. (1976, pl. 3, figs. 1-3) from the Silurian Lipeón Formation (NW Argentina), mainly in having transverse, fainter glabellar furrows S1 and S2, and a narrower (sag.) occipital ring.

Dalmanites paraguayensis (Baldis and Hansen, 1980) (Figs. 2.7-2.10)

1980. Guaranites paraguayensis sp. nov. Baldis and Hansen, p. 60-62, pl. 1, fig. C, pl. 3, figs. a-d.

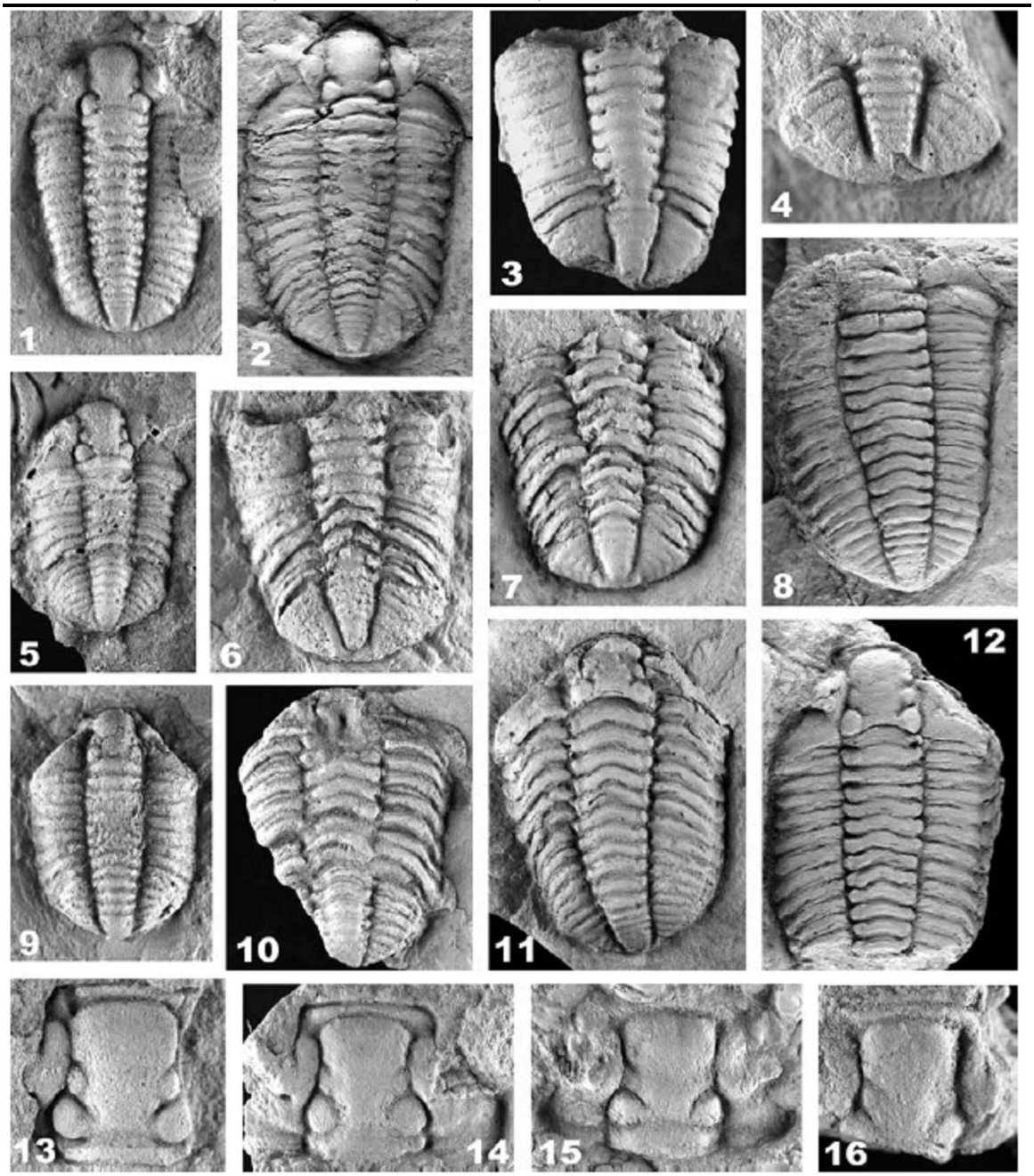

Plate 1. Calymenid trilobites from the Vargas Peña Formation at San Fernando Quarry, Itauguá. 1-7, Calymene boettneri Harrington; 1, axial shield, MLP 31888, level E, x1.5; 2, axial shield, MLP 31877, level E, x1.1; 3, thorax-pygidium, MLP 31869, level F, x1.1; 4, pygidium, MLP 31874, level F, x1.4; 5, axial shield, MLP 31879, level D, x1.9; 6, thorax-pygidium, MLP 31873, level F, x1.1; 7, thoraxpygidium, MLP 31896, level D, x1.4. 8, Calymene cf. boettneri Harrington, thorax-pygidium, MLP 31917, level C, x0.9. 9, Calymene boettneri Harrington, MLP 31885, level E, x1.6; 10-11, Calymene boettneri? Harrington; 10, hypostome, thorax and pygidium, MLP 31910, level C, x1.5; 11, axial shield, MLP 31902, level C, x1.2. 12, Calymene cf. boettneri Harrington, axial shield, MLP 31919, level C, x1.1. 13-16, Calymene sp.A, cranidium; 13, MLP 31906, level B, x1.9; 14, MLP 31904, level C, x1.5; 15, MLP 31916, level C, x1.9;16, MLP 31909, level B, x2.1.

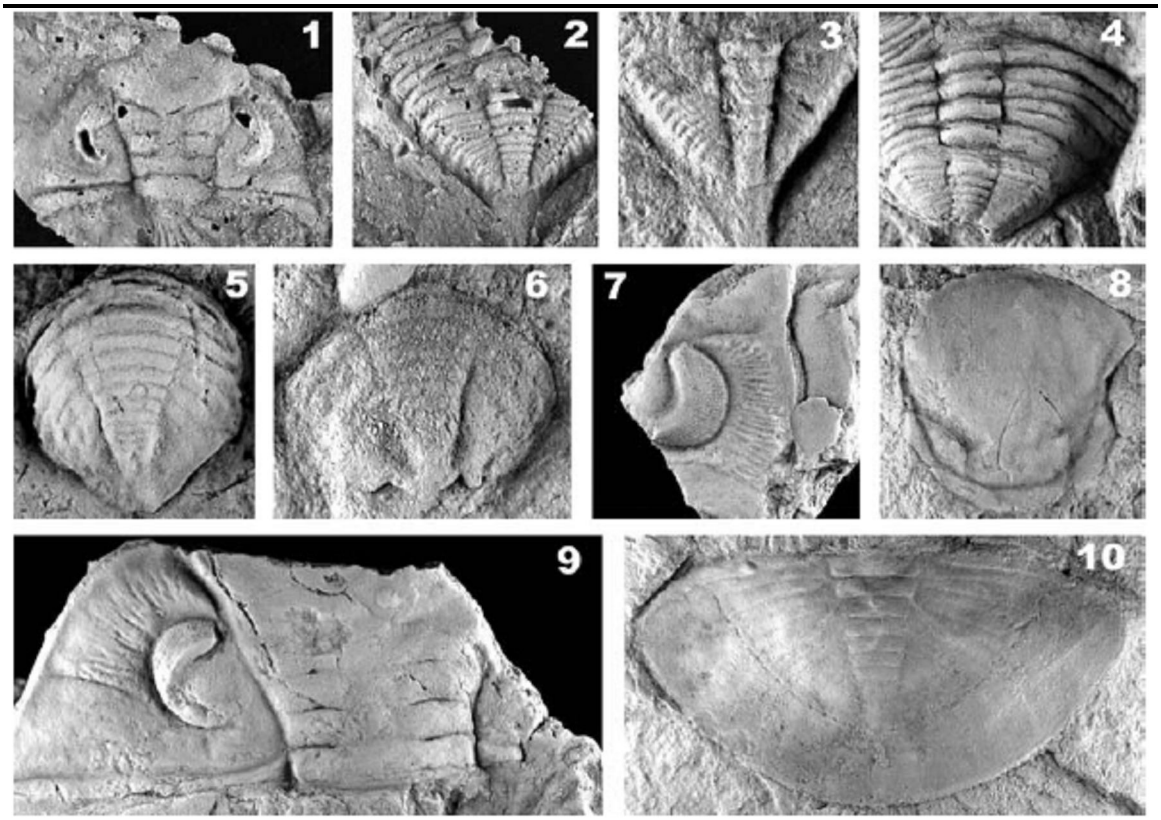

Figure 2. Dalmanitid trilobites from the Vargas Peña Formation at San Fernando Quarry, Itauguá. 1-4, Dalmanites ypacarayensis (Baldis and Hansen); 1, cephalon, MLP 31922, level C, x1.4; 2, fragmentary thorax-pygidium, MLP 31932, level B, x1.4; 3, pygidium, MLP 31930, level C, x2.2; 4, fragmentary thorax-pygidium, MLP 31938, level B, x1.1. 5-6, Trimerus sp., pygidium; 5, MLP 31939, level B, X1.2; 6, MLP 31940, level C, x1.9. 7-10, Dalmanites paraguayensis (Baldis and Hansen); 7, ocular area, MLP 31927, level B, x1; 8, hypostome, MLP 31926, level C, x0.8; 9, fragmentary cephalon, MLP 31923, level C, x0.8; 10, pygidium, MLP 31921, level B, x0.6.

Material. Six fragmentary cephala, 1 hypostome and 2 pygidia (MLP 31920, 31921, 31923-1927, 31929, 31936), levels B, C.

Remarks. Dalmanites paraguayensis is a giant dalmanitid that was fully described by Baldis and Hansen (1980) from the Itacurubi Group of the Vargas Peña locality. It was originally assigned to Guaranites Baldis and Hansen, a name that has been suppressed as a subjective junior synonym of Dalmanites (see Edgecombe in Jell and Adrain, 2003).

CONCLUSIONS

Both calymenid and dalmanitid trilobites are well represented in the Vargas Peña Formation at the type locality, Itauguá. Major diversity [Calymene cf. boettneri Harrington, Calymene sp. A, Trimerus sp., Dalmanites ypacarayensis (Baldis and Hansen), Dalmanites paraguayensis (Baldis and Hansen)] is recorded from the lower middle part of the section, where alternations of clays, shales and sandstones are indicative of changes in ventilation of bottom waters and nutrient supply. Lower graptolites suggest a Rhuddanian age. On the other hand, Calymene boettneri Harrington is restricted to the clays of the middle and upper part of the formation, where it forms a monospecific trilobite assemblage. The graptolites of the upper interval indicate an Aeronian – Telychian age.

Acknowledgements

We thank Carlos Cingolani for his helpful suggestions. María Adela Montalvo kindly assisted in the field. Financial support was provided by the Viceministerio de Minas y Energía, Ministerio de Obras Públicas y Comunicaciones (Paraguay), the Agencia Nacional de Promoción Científica y Tecnológica (PICT 0710829) and the Consejo Nacional de Investigaciones Científicas y Técnicas (PIP 5027) (Argentina).

REFERENCES

Baldis, B.A.J. and Hansen, H. 1980. Trilobites dalmanítidos de Paraguay Oriental. Actas II Congreso Argentino de Paleontología y Bioestratigrafía y I Congreso Latinoamericano de Paleontología (Buenos Aires), 1, 49-67.

Baldis, B.A.J., Benedetto, J.L., Blasco, G. and Martel, M.E.1976. Trilobites Siluro-Devónicos de la sierra de Zapla (Noroeste de Argentina). Ameghiniana, 13, 185-225.

Barrande, J. 1852. Système Silurien du Centre de la Bohême. I. Recherches Paléontologiques, vol. 1 (Crustacés Trilobites). Prague and Paris, 1-935, 51 pl.

Benedetto, J. L., Sánchez, T.M. and Brussa, E.D. 1992. Las Cuencas Silúricas de América Latina. In J.C. Gutiérrez Marco, J. Saavedra and I. Rábano (eds.), Paleozoico Inferior de Ibero-América. Universidad de Extremadura, 119-148.

Brongniart, A. 1822. Les trilobites. In A. Brongniart and A.-G. Desmarest, Histoire naturelle des Crustacés fossils, sous les rapports zoologique et géologiques. Paris, 1-65.

Green, J. 1832. A monograph of the trilobites of North America; with coloured models of the species. Philadelphia, 1-94.

Harrington, H.J. 1950. Geología del Paraguay Oriental. Contribuciones Científicas, Serie E: Geología, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad de Buenos Aires, 1, 89 pp.

Harrington, H.J. 1972. Silurian of Paraguay. In W.B.N. Berry and A.J. Boucot (eds.), Correlation of South American Silurian rocks. Geological Society of America, Special Paper, 133, 41-50.

Jell, P.A. and Adrain, J.M. 2003. Available generic names for trilobites. Memoirs of the Queensland Museum, 48 (2), 331-553.

Koren', T.N. and Rickards, R.B. 1996. Taxonomy and evolution of Llandovery biserial graptoloids from the southern Urals, western Kazakhstan. Special Papers in Palaeontology, 54, 1-103.

Lapworth, C. 1873. On an improved classification of the Rhabdopleura. Geological Magazine, 10, 500-504, 555-560.

Legrand, P. 1987. Modo de desarrollo del Suborden Diplograptina (Graptolithina) en el Ordovícico Superior y en el Silúrico. Implicaciones taxonómicas. Revista Española de Paleontología, 2, 59-64.

Uriz, N.J., Alfaro, M.B. and Galeano Inchausti, J.C. 2006. Graptolitos monoseriados del Llandoveriano medio-superior de la Formación Vargas Peña, Paraguay oriental. Resúmenes IX Congreso Argentino de Paleontología y Bioestratigrafía (Córdoba), 167.

Waisfeld, B.G., Toro, B.A. and Brussa, E.D. 1988. Trilobites silúricos de la Formación Los Espejos, sector occidental del cerro Del Fuerte, Precordillera de San Juan, Argentina. Ameghiniana, 25, 305-320.

Wolfart, R. 1961. Stratigraphie und Fauna des älteren Paläozoikums (Silur–Devon) in Paraguay. Geologische Jahrbuch, 78, 29-102.